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Perinatal care in Portugal: Effects of 15 years of a regionalized system

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Abstract
Aim: To share information on the organization of perinatal care in Portugal. *Methods:* Data were derived from the Programme of the National Committee for Mother and Child Health 1989, National Institute for Statistics, and Eurostat. *Results:* In 1989, perinatal care in Portugal was reformed: the closure was proposed of maternity units with less than 1500 deliveries per year; hospitals were classified as level I (no deliveries), II (low-risk deliveries, intermediate care units) or III (high-risk deliveries, intensive care units), and functional coordinating units responsible for liaison between local health centres and hospitals were established. A nationwide system of neonatal transport began in 1987, and in 1990 postgraduate courses on neonatology were initiated. With this reform, in-hospital deliveries increased from 74% before the reform to 99% after. Maternal death rate decreased from 9.2/100 000 deliveries in 1989 to 5.3 in 2003 and, in the same period, the perinatal mortality rate decreased from 16.4 to 6.6/1000 (live births + stillborn with $\geq$22 wk gestational age), the neonatal mortality rate decreased from 8.1 to 2.7/1000 live births, and the infant mortality rate from 12.2/1000 live births to 4/1000.

Conclusion: Regionalization of perinatal care and neonatal transport are key factors for a successful perinatal health system.

Key Words: *Mortality rates, neonatal transport, organization of perinatal care, regionalization*

Introduction

The quality of perinatal care expressed as maternal, perinatal, neonatal and infant mortality rates, is influenced not only by the availability of medical technology, and the improved educational, social and economic status of the population, but also by perinatal care organization. It is difficult to implement and maintain a national programme of perinatal care, especially when faced with popular hopes and beliefs, and local political power. However, it can be done.

Portugal has close to 10 million inhabitants, mostly distributed along the coast and in larger cities. National healthcare is freely available to everyone.

The modern era of Portuguese neonatology began in 1980 with the opening of the country's first neonatal intensive care units (NICUs). Today, there are 22 NICUs—two of them on the Portuguese islands of Madeira and the Azores, and two in private hospitals. The number of live births has been falling, and it was 112 589 in 2003. In 1989, a reform of the perinatal care system was introduced.

The aim of this paper is to convey information on the organization of perinatal care in Portugal and discuss the results of its regionalization.

Definitions and methods

Live birth is defined as a newborn with heart beat, respiratory or voluntary movements, and a gestational age $\geq$22 wk; this limit of gestational age also applies to the definition of stillborn. Perinatal mortality includes deaths occurring up to 7 d of life, and is expressed per 1000 live births and stillborns of gestational age $\geq$22 wk. Maternal mortality rate is defined as any death related to pregnancy, delivery or post-delivery, per 100 000 deliveries. Very low birthweight (VLBW) is defined as birthweight under 1500 g.

All data were obtained from National Institute for Statistics (INE) reports. After 1996, data on VLBW infants were also obtained from the Portuguese National VLBW Network [1].

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Organizational data: The reform of perinatal care

In 1987, the Ministry of Health nominated a Committee of Experts to assess the state of perinatal healthcare throughout the country. In 1989, based on this assessment, the committee recommended major structural changes, resulting in the present Perinatal Healthcare System. The reform was a 9-y programme in 3-y steps [2], including some measures which, although unpopular, were implemented: 1) proposed closure of maternity units with less than 1500 deliveries per year; 2) classification of hospitals into levels I, II and III; 3) functional coordinating units between hospitals and local health centres; 4) special training in neonatology—a postgraduate course of 6 mo (later 1 y) starting in 1990; 5) establishment of a network of perinatal referral hospitals in the north, centre and south of Portugal; 6) provision of neonatal intensive and intermediate care units for level III and level II hospitals, respectively; 7) advice on medical and nursing requirements to ensure unit feasibility; 8) advice on in-uterus transport but also provision of transport for those babies born outside the centre, thus creating a Nationwide Neonatal Transport System.

As a result of this reorganization, several maternity units were closed, deliveries occurring in health centres and level I hospitals ceased, and since then levels of perinatal medical care have become more apparent (Figure 1). In local health centres and level I hospitals there are no deliveries, and normal and low-risk pregnancies are cared for by family physicians. In level II hospitals, normal and low-risk pregnancies are cared for by obstetricians, and newborns by paediatricians with training in neonatology; there are neonatal intermediate care units and the possibility of providing short-course ventilation, if necessary, whilst waiting for neonatal transport to referral centres. Level III hospitals are referral centres, caring for high-risk pregnancies and high-risk newborn infants with obstetricians, neonatologists and NICUs [3,4]. For their own district population, these level III hospitals function as level II hospitals. NICUs have between five and 12 intensive care cots, and provide long-term ventilation, high-frequency oscillation (HFO), inhaled nitric oxide (iNO) and early nasal continuous airway pressure (ENCPAP). Seven of these hospitals are neonatal surgical referral centres, and four are neonatal cardiac referral centres. In-uterus transport is accomplished for almost all infants with a gestational age of <32 wk, prenatal diagnosis of congenital malformations or high-risk pregnancies—multiple pregnancy under 34 wk gestational age, severe blood group immunization, fetal hydropsis, fetal metabolic disorders and severe maternal diseases (pregnancy related or otherwise). The Nationwide Neonatal Transport System is part of the Ministry of Health's National Institute of Medical Emergency. There are three centres—North, Centre and South, each of them placed at a level III hospital—with a centralized information system that allows transferral of the neonate to the most suitable NICU according to special needs—surgical condition to a surgical centre, for example—or to where cots are available. An ambulance is only made available for newborn infants. It is equipped with a NICU, and the newborn is cared for by a neonatologist and a neonatal nurse with expertise in neonatal transport.

In 1994, a National VLBW Infants Network was organized. Five years' data of this network were published and successfully submitted for an international award, the Bial Clinical Medicine Award 2002 [1].

Results

With the reform came the closure of more than 150 public maternity units, and the number of hospitals

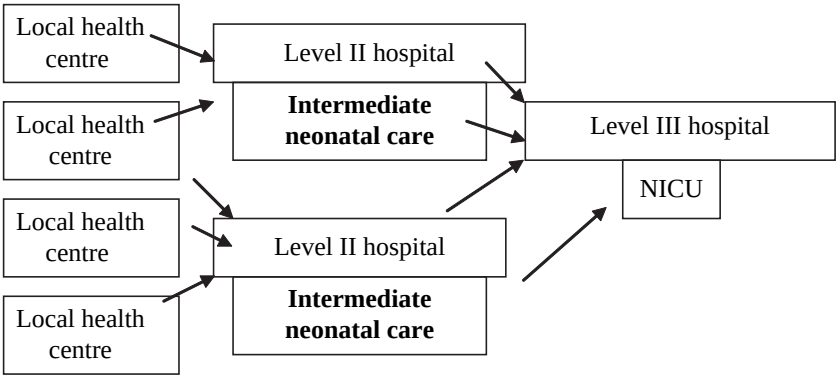

Figure 1. Model of healthcare organization in Portugal. Health centres and level I hospitals have no deliveries. Level II hospitals deliver normal and low-risk newborns, have intermediate care units, and provide short-course ventilation until arrival of neonatal transport. Level III hospitals are referral centres providing long-course ventilation, repair of surgical conditions, care for VLBW newborns, cardiac anomalies, etc. In-uterus transport is the goal but some unexpected deliveries of preterm or malformed newborns benefit from a National Neonatal Transport system.

with deliveries decreased from more than 200 to 51. In spite of this, the rate of in-hospital deliveries increased from 74% previously to 99% after the reform.

The maternal death rate decreased from 9.2 in 1989 (before the reform) to 5.3 in 2003, and perinatal mortality from 16.4 to 6.6 (per 1000 stillbirths plus live births of more than 500 g birthweight). Late fetal mortality decreased from 6.8 in 1990 to 2.7 in 2004. Between 1989 and 2003, the neonatal mortality rate decreased from 8.1 to 2.7/1000 live births, and infant mortality from 12.2 to 4 per 1000 live births (Table I); in 2004 they were 2.6 and 3.8, respectively. In Table II, it is possible to compare the evolution of infant mortality rates in Portugal, several European countries and the USA between 1990 and 2003. In recent years, congenital anomalies have been the primary and secondary causes of fetal and infant mortality, respectively. Thirty-eight per cent of VLBW infants are transported in uterus to be born at a level III hospital, and 91% of all VLBW infants are born at the centre in which they are cared for. As a consequence, there was a decrease in neonatal transport from 15% to 9% between 1996 and 2004. The average national rate of prenatal steroids was 84% in 2004, and in some regions may be as high as 95%. The mortality rate of VLBW neonates has been declining gradually, from 26.9% in 1996 to 15.4% in 2004; 6.1% for newborns with birthweight over 1000 g and 29.6% for those below 1000 g [1,5–8] (Figure 2). The lower limit of viability in 2004, defined as the lowest gestational age with a survival rate of over 50%, was 25 wk; it was 28 wk for survival over 50% without sequelae on discharge [1].

Discussion

Social and economic conditions in Portugal have improved greatly over the last 15 years. In the same period, profound changes to the organization of perinatal care have been implemented at a time when improvements in neonatal care, such as surfactant therapy, prenatal steroids and new modes of ventilation (HFO, iNO and ENCPAP), have influenced perinatal and neonatal mortality rates all over the developed world. It is hard to attribute improvements to only one factor, and Portuguese results were certainly influenced by several. However, if only conditions related to innovation, such as new strategies for improving pulmonary function, had influenced these indicators, a slow decrease similar to that seen in other countries would have been expected (Figure 2). In fact, Portugal surpassed many European countries to occupy fifth position in the rankings, instead of last place as has been the case in the recent past.

It could be argued that good prenatal diagnosis may detect congenital malformations, which could in turn imply a high rate of abortion, leading to lower mortality rates (neonatal and infant). As a matter of fact, ultrasound is advised at 12 wk, an initial morphological exam between 18 and 22 wk, and a last one at 32 wk. By law, therapeutic abortion is allowed until 24 wk of gestation, unless the malformation is incompatible with life, in which case it may be done at any time. Unfortunately, many people do obstetrical ultrasound out of referral centres and, so, prenatal diagnosis might be one of

Table I. Mortality rates during the last 14 y (according to the National Institute for Statistics).

	1989	1999	2003
Maternal	9.2	2.5 (2000)	5.3
Perinatal	16.4	8.5	6.6
Late fetal	6.8 (1990)	3.7 (2000)	3.1
Neonatal	8.1	3.6	2.7

Perinatal mortality rate includes all newborns of more than 22 wk gestational age.

Table II. Relative evolution of infant mortality rates in European countries and the USA (Eurostat).

	1990	2003
Portugal	11	4
France	7.3	3.9
Germany	7	4.2
Belgium	8	4.3
Denmark	7.5	4.4
Netherlands	7.1	4.8
UK	7.9	5.3
Sweden	6	2.8
Finland	5.6	3.1
Spain	7.6	3.2
Italy	8.2	4.3
EEC/EU	7.6	4.6
USA	8 (1994)	7 (2002)

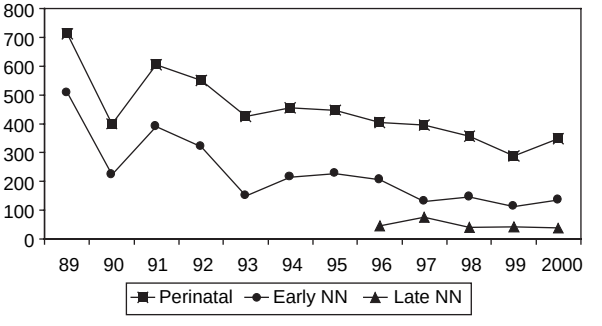

Figure 2. VLBW mortality rates. Perinatal and early neonatal (NN): per 1000 live births plus stillborns, with birthweight over 500 g; late neonatal: per 1000 live births >500 g. Figures according to the National Institute for Statistics.

the major Portuguese insufficiencies of prenatal care. Partly because of this, congenital anomalies are the primary and secondary causes of late foetal and infant mortality, respectively.

In the United States, the infant mortality rate was 6.8 in 2001 and 7 in 2002 [9]. In the same years, the figures for Portugal were 5.1 and 5, respectively. In 2003, the EU had a rate of 4.6/1000, while Portugal had 4/1000. Usually the quality of perinatal care is evaluated by maternal, fetal and neonatal mortality and morbidity [10] whilst, for some authors, infant mortality rate is a better indicator of economic and social conditions [11]. However, infant mortality is so influenced by congenital or perinatal conditions, most of them leading to death after 28 d of life, that it is quite unreasonable not to consider it an indicator of quality of perinatal care. Moreover, in Portugal, all indicators—maternal, perinatal, fetal, neonatal and infant mortalities—improved. This improvement has been sustained, even over the last few years when a reversal would have been expected given the influx of new immigrants from Eastern European countries and China with suboptimal social conditions and poor access to healthcare. We believe that organizational features with well-defined commitments at each level of care, and regionalization, in-uterus transferral and the neonatal transport system greatly contributed to this impressive lowering of mortality rates [12].

The closure of small maternity units—those without enough deliveries and experience to maintain high levels of obstetric care—was probably the most important but also the most difficult and controversial measure to implement and maintain, as it faced opposition from local political powers and inhabitants. Also, in spite of the great increase in intrauterine transport, we should emphasize that the Portuguese Neonatal Transport System, with its own neonatal team recruited amongst NICU staff, is part of the success, stabilizing the newborn before transport and identifying the most suitable destination for mother and child [13].

Conclusion

In spite of a delay in development up to April 1974, the small percentage of GDP ascribed to public health compared to other countries, and the maintenance of a free healthcare system, it is noteworthy that we advanced several decades in just a few years. Data reflect not only an improvement in Portuguese social and economic conditions but also the benefits of organizational measures—regionalization, in-uterus transport and the neonatal transport network.

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